

MI Extraction Studies

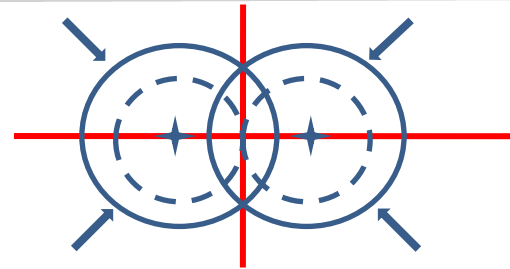
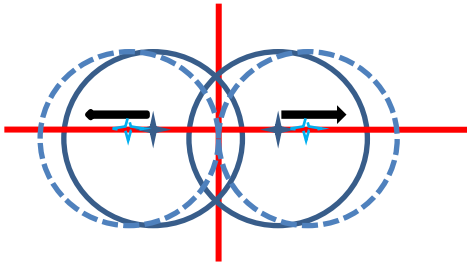
John A. Johnstone

11.22.2010

Special thanks to Denton & Peter!

(very little, if any, thanks to John & Leo)

Extraction Techniques & Study Plan



In both historical & alternative extraction techniques, harmonic (53^{rd}) quad circuits are ramped to establish phase space orientation at the septum wires

Historical

Q53 circuits are ramped to drag the stop-band through the beam

Alternative

0^{th} harmonic quads ramp the beam through the stop-band

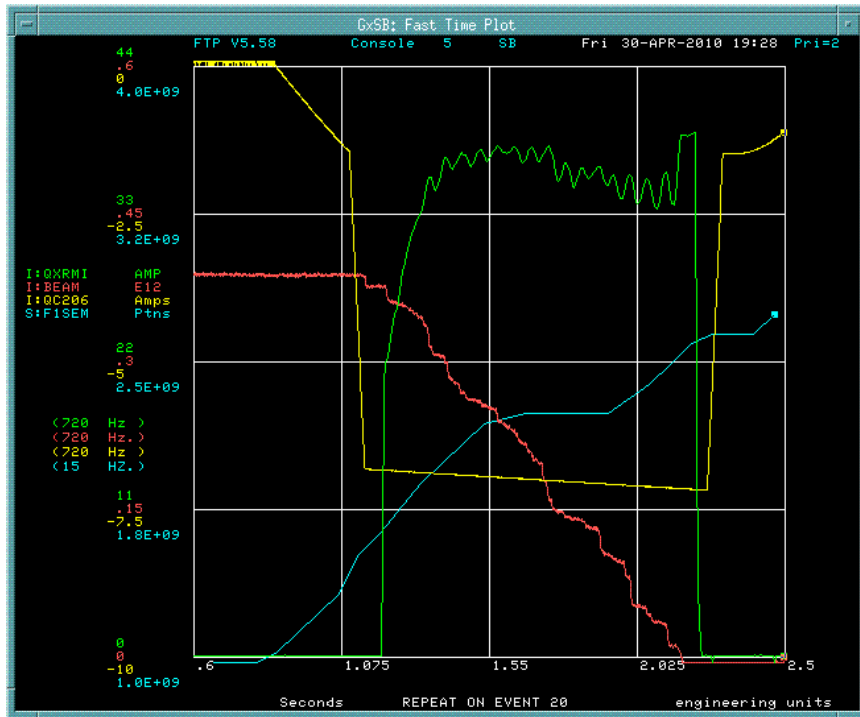
Analytic modeling & simulations predict that the “historical” approach is completely inappropriate with large tune spreads[†].

Studies

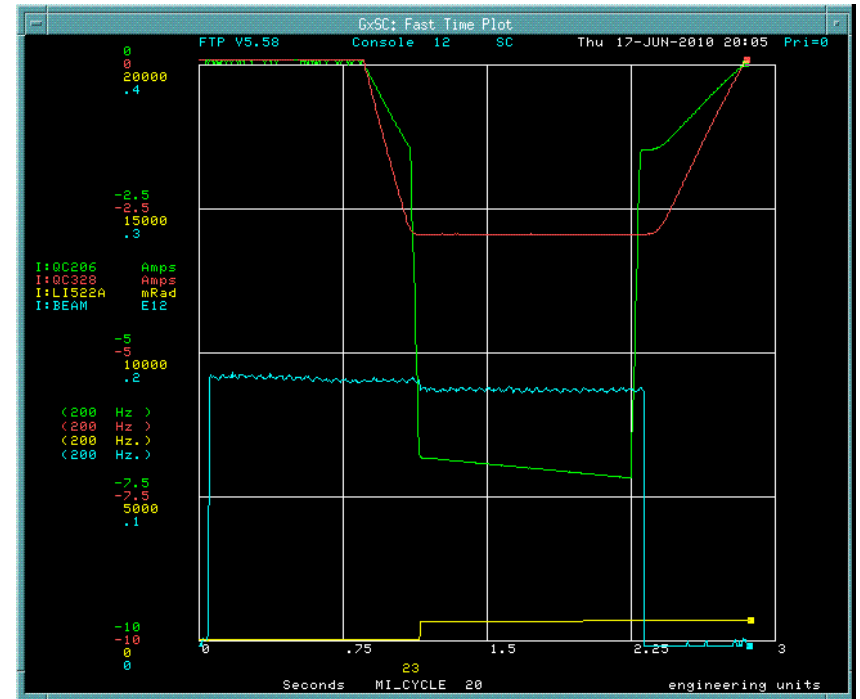
- benchmark the 2 techniques at 120 GeV/c with nominal beam parameters
- compare losses with large (linear) tune spreads at 120 GeV, and then move on to 8 GeV.

[†] John Johnstone, *An Alternative Approach to $1/2$ Integer Extraction Using a Supplementary 0^{th} -Harmonic Quadrupole Circuit*, Mu2e-doc-576.

Slow Spill Established April 30th, 2010

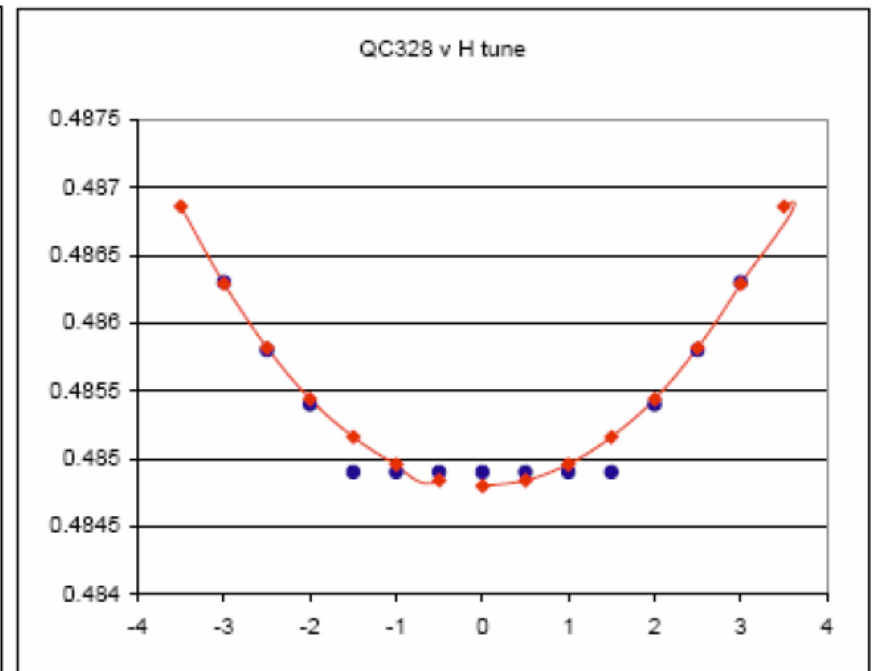
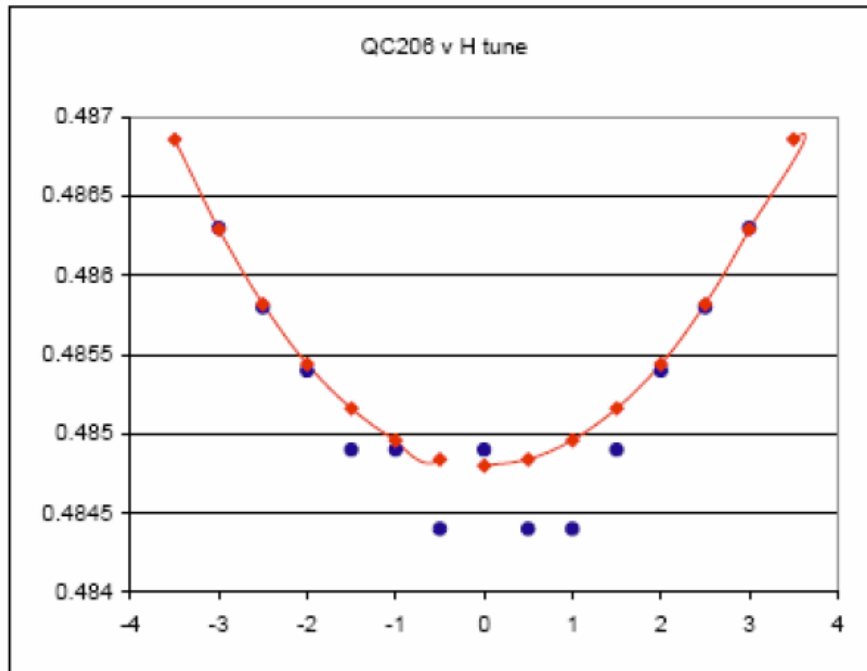


1 sec slow spill established with
QC206 ramped + QXR regulation



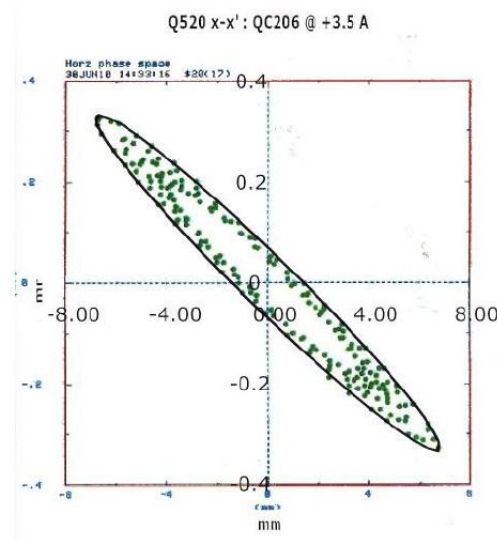
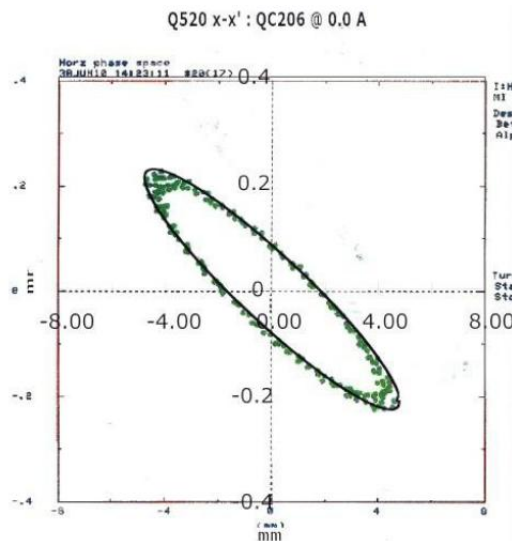
QC206 ramped & QXR off –
**No spill was possible without
QXR**

Quadratic Tune Shifts & MI Stop-band Correction

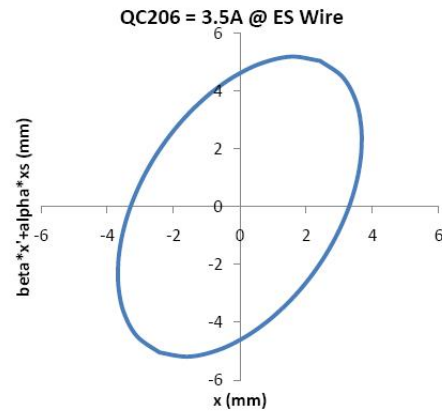
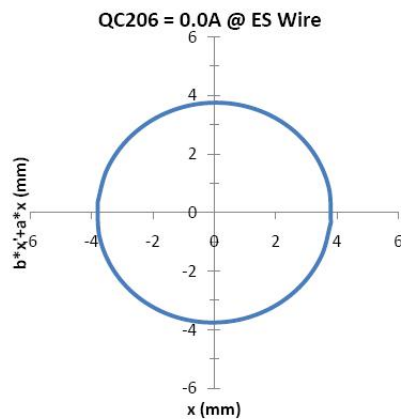


Dots = Measured
Solid = *Predicted*

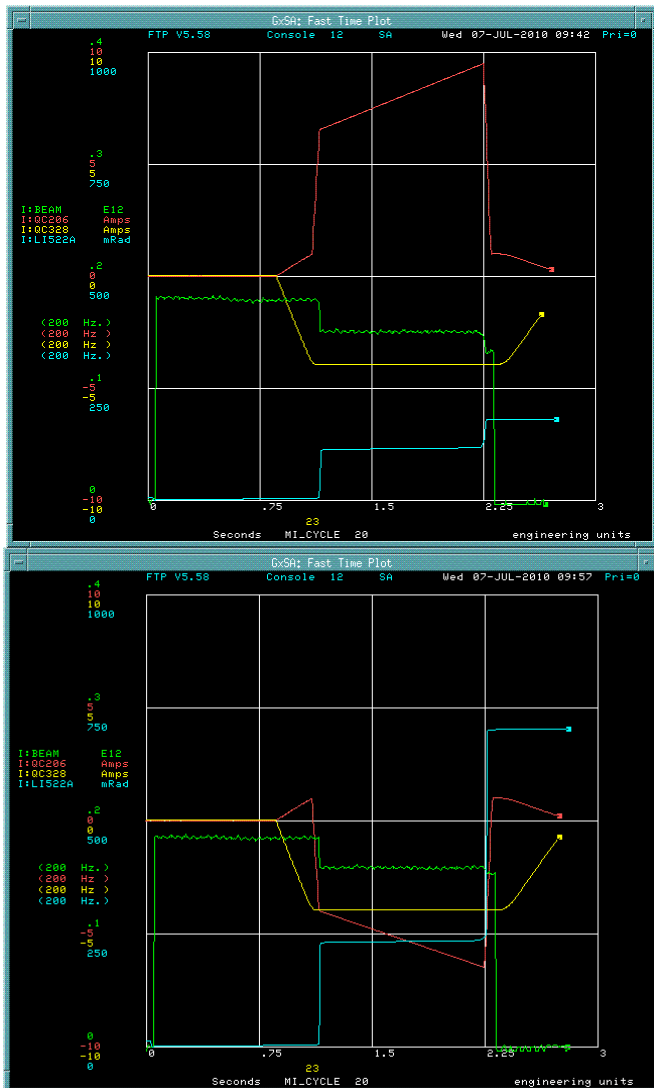
Phase Space at Q520



Dots = Measured
Solid = **Predicted**



Latest Extraction Attempt – July 7th, 2010



Despite the excellent agreement between the predicted & measured behavior of tunes & phase space with 53rd-harmonic quad momentum bumps ...

Neither the magnitude nor polarity of the 53rd-harmonic extraction quads' fields during the time bump has had any impact on beam spill.

When this conundrum is resolved, studies will proceed to examining extraction with large tune spreads at 120 & 8 GeV

